

COMPARATIVE EFFICACY OF BIO AGENTS FOR THE MANAGEMENT OF WILT DISEASE OF PIGEONPEA [*CAJANUS CAJAN* (L.) MILLSP.]

KUNWAR ZEESHAN KHAN, SHAFAT AHMAD,
MANISHA PANDEY & KUNWAR FAIZAN KHAN

Department of Plant Pathology, Department of Agronomy, Sam Higginbottom Institute of
Agriculture, Technology & Sciences (Deemed University), Allahabad, Uttar Pradesh, India

ABSTRACT

*Pigeonpea is an important pulse crop in India, accounting for almost 90% of world's area and production, affected by the several pathogens. Wilt caused by *Fusarium udum* is a most important disease of Pigeonpea. A trial was conducted to evaluate the effectiveness of above selected biocontrol agents against the wilt of pigeonpea under pot condition. The treatments were *Trichoderma viride* @ 5gm/kg of soil, *T. harzianum* @ 5gm/kg of soil with FYM and without FYM against the *Fusarium udum* as soil treatment and Neem cake, Carbendazim also taken for comparison in the pot conditions. All the treatments significantly reduce the wilt incidence but *Trichoderma viride* with (88.89 %) disease inhibition recorded most effective followed by *T. viride* +FYM (87.84 %), Carbendazim (87.13 %), *T. harzianum* (81.22 %), *T. harzianum*+FYM (80.04 %), Neem cake (70.61 %) over the control. The germination percentage was also increase with all treatment but *T. viride* was increase highest germination percentage followed by rest of treatments over the control.*

KEYWORDS: *Pigeonpea, Wilt Disease, *Fusarium udum*, *Trichoderma* sp., Management*

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INTRODUCTION

Pigeonpea (*Cajanus cajan* (L.) Millsp.) belongs to family *Leguminosae* is one of the major pulse crop of tropics and sub tropics. Pigeonpea is one of the most extensively grown legume crops in India, accounting for almost 90% of world's area and production (Dhanasekar *et al.*, 2010). Every Pigeonpea plant is a mini-fertilizer factory as the crop has unique characteristic of restoring and maintain soil fertility through fixing atmospheric nitrogen in symbiotic association with *Rhizobium* bacteria present in the root nodules. Being a drought resistant crop, it's suitable for dry land farming. Pigeonpea supplies a major share of protein requirement of vegetarian population of the country.

Vascular wilt of pigeonpea caused by *Fusarium udum* is the most important disease, causing more economic damage to the crop. The fungus can survive on infected plant debris in the soil for about three years and causes serious yield losses, sometimes upto 100% in susceptible cultivars (Kiprop *et al.*, 2002). The total production loss due to this disease in India alone was estimated to be approximately 97,000 tones per year (Saxena *et al.*, 2010). The disease was first recorded by Butler (1906) in India. Although the disease is more prevalent in India, east Africa and Malawi where field losses of over 50% are common, it also occurs in Bangladesh, Grenada, Indonesia, Mauritius, Myanmar, Nepal, Nevis, Venezuela, Trinidad, and Tobago

(Kannaiyan *et al.*, 1984). Being a soil-borne pathogen, *Fusarium udum*, the fungus enters the host vascular system at root tips through wounds leading to progressive chlorosis of leaves, branches, wilting and collapse of the root system. Although the infection occurs in the early seedling stage, symptoms are not visible until later in crop developmental stages (Reddy *et al.*, 1990).

Fungicides are reported to cause adverse effects on treated soil because of their non-biodegradable nature and also because they induce resistance in pathogens (Garbeva *et al.*, 2010). Biocontrol agents have the potential to replace or augment conventional plant disease management. Several studies have demonstrated reduced incidence of diseases in different crops after treating the soils with fungal or bacterial antagonists (Mohammed *et al.*, 2014; and Mishra *et al.*, 2013). *Trichoderma* is the one of the potential bio-control agent for controlling disease like vascular wilt caused by *Fusarium* and other diseases. *Trichoderma* spp. is regarded as ideal antagonist for use as bio-control agents. It is because their antagonistic potential is not much altered with change the environment condition except under extreme conditions. Species of *Trichoderma* have been utilized as agent for biological control for several soil borne pathogens (Garret. 1980). Wilt of pigeonpea caused by *Fusarium udum* is the most important disease, causing more economic damage to the crop. Biological controls are best alternative to chemicals fungicide against *Fusarium udum*. As the agriculture, shift towards the organic farming so the Biological controls have much better scope in the pest management practices.

MATERIALS AND METHODS

The experiment was conducted in the research laboratory and experimental pods behind the Department of Plant Pathology, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Deemed to be University, Allahabad.

Isolation of Pathogen

Fusarium udum used in the experiment was isolated in pure culture from the root of infected pigeonpea plants were uprooted, washed and sterilized with 0.1% HgCl₂ for 1-2 seconds. Previously, before culturing, infected part were viewed under microscope for ascertaining examination of conidia. By applying HgCl₂ tissues get surface sterilized so to minimize the contamination. Already sterilized, melted PDA medium was transferred in to petriplates and than small pieces of pigeonpea infected roots were kept on semi-solidified medium inside petriplates. This whole process was done inside the culture room under inside the highly aseptic conditions. Now these petriplates were incubated in the incubator at 25±2°C temp. After 3days, a white's cottony growth was observed, from this growth a slight portion was observed under microscope for conform the growth of the same pathogen. The pure culture was maintained on PDA slants. The pathogenicity of the isolated fungus was tested following Koch's postulates in a pot experiment on pigeonpea which were found most susceptible to wilt under natural conditions. For the isolation of *Trichoderma* spp. soil sample were collected from root region area of pigeonpea plants from the field. After isolating the *Trichoderma* by serial dilution method the pure culture was maintained on PDA slants.

Multiplications of *Fusarium udum*

The culture of *Fusarium udum* was multiplied on sand pigeonpea flour medium (1:1). 15 g of pigeonpea flour mixed in 85 g river bed sand and was filled in the conical flask of 250 ml capacity (50 g/flask) and sterilized in autoclave at 15 Lbs for 30 min. When medium was cooled, then pathogen was inoculated aseptically with pure culture of *Fusarium udum* and incubated at room temperature for 15 days (Mesapogu *et al.*, 2011).

Preparation of the Experimental Site and Sowing the Seed

The selected pots were washed by tap running water than sterilized by 0.1% HgCl₂, and fill with sterilized soil. Sick the soil before 15 days and then sown the pigeonpea seed (Nene *et al.*, 1981). Inoculum of the *F. udum* (sorghum colonized seeds) was applied in soil @ 5 g colonized sorghum seeds/kg soil fifteen days before sowing. Application of biocontrol agent was done at the time of sowing. Treatments with biocontrol agents were done @ 5 g biocontrol agents /kg soil. After inoculation of pathogen and treatments, seed were sown@12 seed/pot in all 24 pots.

Following observations were recorded :

- Germination percent
- Wilt incidence

$$\text{Disease incidence (\%)} = \frac{\text{No.of infected plant}}{\text{Total no.of Plant}} \times 100$$

In the experiment Randomized Block Design (RBD) was adopted. The analysis of variance (ANOVA) technique was applied for drawing conclusion from data. The calculated values were compared the tabulated values at 5% level of probability (Fisher and Yates, 1959) for the appropriate degree of freedom.

RESULTS AND DISCUSSIONS

Effect of *Trichoderma* spp. as Soil Treatment on the Germination Percent of Pigeonpea

During this pot trial, the highest germination percent was 93.67. It is evident from data presented Table 1 and Figure 1 all the treatment were effectively increase the germination percent compare to control. Maximum germination percent (93.67) was recorded in the soil application of *Trichoderma viride* followed by carbendazim (82.55), *Trichoderma viride* +FYM (77.78), *Trichoderma harzianum* (75.00), *Trichoderma harzianum* +FYM (69.44), Neem cake (61.11) in treatment (T₆), uninoculated Control (52.78), inoculated control (25.00). However, *Trichoderma viride* @ 5g/kg (T₂) soil treatments was found superior among all the treatments in managing the wilt incidence. Poorest disease control among all treatments was found with neem cake. Similor result have been reported by Charti *et al.*, (1998) who conduct a pot trial and observed that seed treatment with *Trichoderma harzianum* gave maximum seed germination (98%) of pigeonpea.

Table 1 : Effect of *Trichoderma* Spp. as Soil Treatment on the Germination Percentage of Pigeonpea 15 Day after Sowing

	Treatments	Germination %
T ₀	Uninoculated Control	52.78
T ₁	Inoculated Control.	25.00
T ₂	<i>Trichoderma viride</i> .	93.67
T ₃	<i>Trichoderma viride</i> + FYM	77.78
T ₄	<i>Trichoderma harzianum</i>	75.00
T ₅	<i>Trichoderma harzianum</i> + FYM	69.44
T ₆	Neem cake.	61.11
T ₇	Carbendazim	82.55
	F test	S
	S. Ed (±)	7.34
	CD	15.75

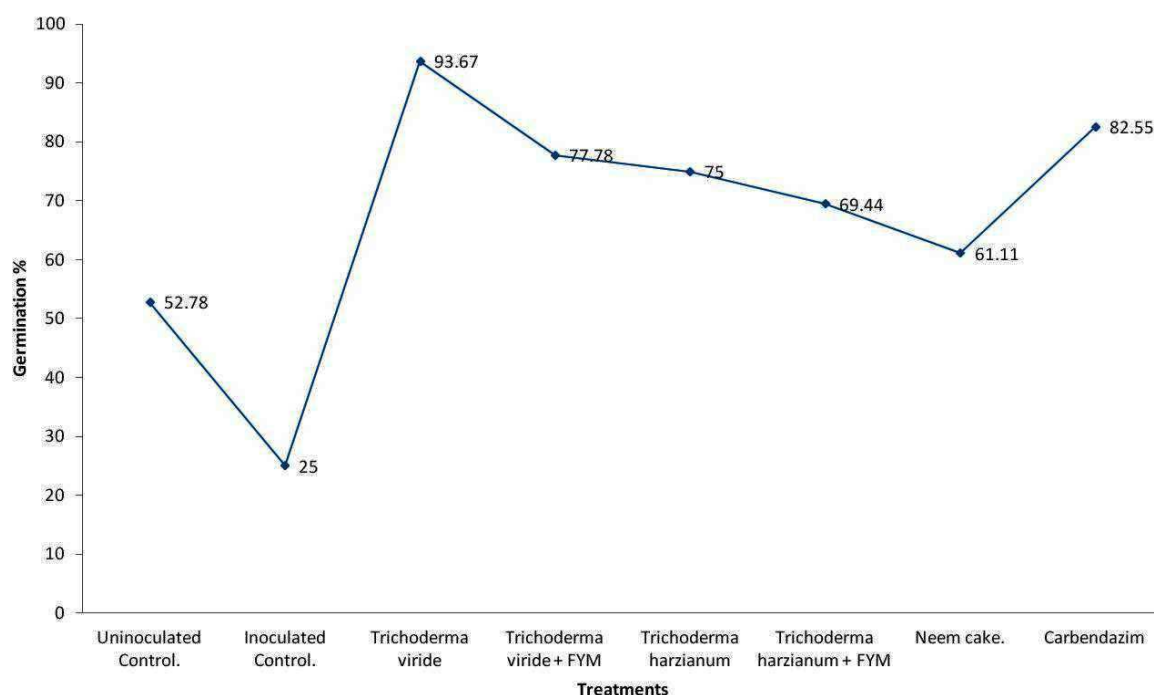


Figure 1 : Effect of *Trichoderma* Spp. as Soil Treatment on the Germination Percentage of Pigeonpea

Effect of *Trichoderma* Spp. as Soil Treatment on the Disease Incidence of Pigeonpea

The present investigation has generated information shown in Table 2 and Figure 2 in significant effect of bio agents on pigeonpea at 30, 60 and 90 day after sowing. All the treatment were found statistical significant over *Fusarium* inoculated and uninoculated control and non-significant with each other but observations recorded on 90 DAS as shown in Table 1 pertaining to mean percent disease incidence reveal that it was lowest in *T. viride* (5.81), followed by *T. viride* +FYM (6.36), carbendazim (6.73), *T. harzianum* (9.82), *T. harzianum* +FYM (10.44), Neem cake (15.37), uninoculated Control (25.74), inoculated control (52.31). It is also evidence in the table that Disease inhibition percent over the control at 90 DAT was highest in *Trichoderma viride* (85.40), followed by *Trichoderma viride* +FYM (84.02), carbendazim (83.09), *Trichoderma harzianum* (82.31), *Trichoderma harzianum* +FYM (73.77), Neem cake (71.86). However, *T. viride* @ 5 g/kg soil treatment was found superior among all the treatments in managing the wilt incidence. Least significant was found with neem cake treatment. **Biswas and Das (1999)** obtained result in their green house studies they reported that seed treatment of pigeonpea with *T. harzianum* spores failed to reduce wilt where as soil application of *T. viride* growth on maize meal sand medium at 40-60g/kg soil gave 89% disease control.

Table 2: Effect of *Trichoderma* Spp. as Soil Treatment on the Disease Incidence of Pigeonpea at 30, 60 and 90 Day after Sowing

	Treatments	Disease Incidence %		
		30 DAS	60 DAS	90 DAS
T ₀	Uninoculated Control.	14.54	22.04	5.74
T ₁	Inoculated Control.	31.94	39.81	52.31
T ₂	<i>Trichoderma viride</i> .	2.78 (91.29)*	5.81 (85.40)*	5.81 (88.89)*
T ₃	<i>Trichoderma viride</i> + FYM	3.03	6.36	6.36

		(90.51)*	(84.02)*	(87.84)*
T ₄	<i>Trichoderma harzianum</i>	3.33 (89.57)*	7.04 (82.31)*	9.82 (81.22)*
T ₅	<i>Trichoderma harzianum</i> + FYM	3.70 (88.41)*	10.44 (73.77)*	10.44 (80.04)*
T ₆	Neem cake.	7.87 (75.36)*	11.20 (71.86)*	15.37 (70.61)*
T ₇	Carbendazim	3.03 (90.51)*	6.73 (83.09)*	6.73 (87.13)*
	F test	S	S	S
	S. Ed (±)	4.96	5.61	4.727
	CD	10.65	12.03	10.739

*Disease inhibition percent over the control

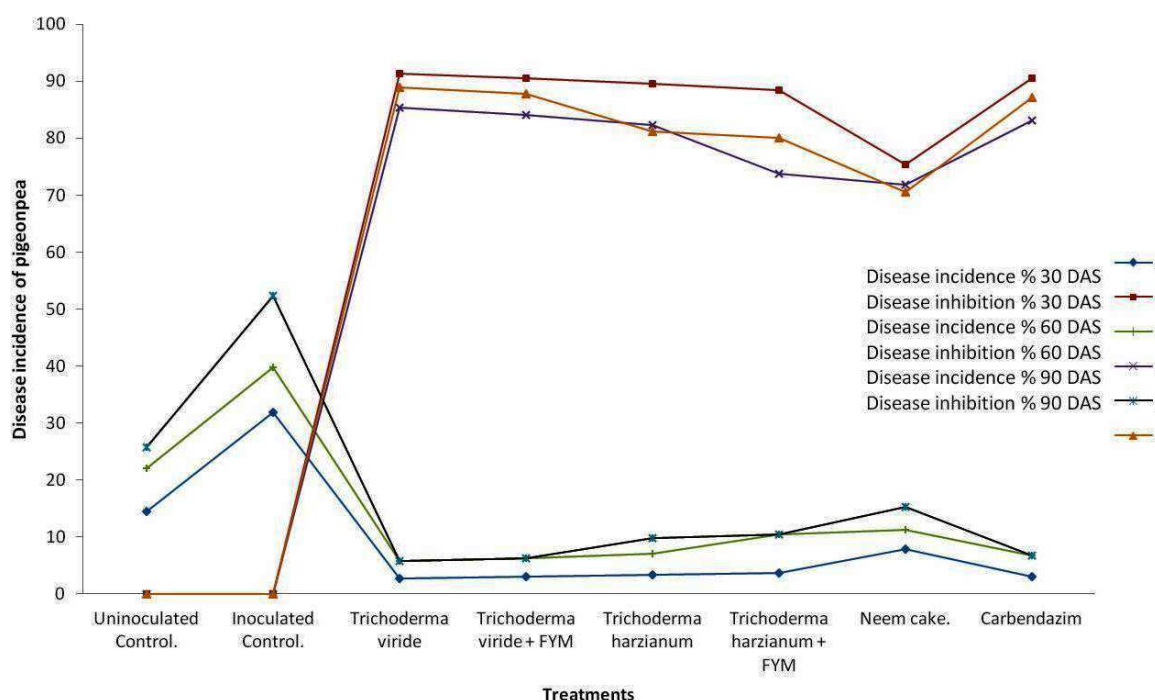


Figure 2: Effect of *Trichoderma* Spp. As Soil Treatment on the Disease Incidence of Pigeonpea at 30, 60 and 90 Day after Sowing

These results indicated the superiority of soil application over seed treatment of biocontrol agent. This might be due to the fact that the antagonists like *Trichoderma* grow rapidly when inoculated in the soil resulting in the competition for the nutritional factors and rhizosphere colonization.

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